RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

CGIAR CCAFS

The SmartAG Partner

CCAFS East Africa Quarterly Newsletter

January - March 2015

Editing: Vivian Atakos, Maren Radeny, Mary Nyasimi, Catherine Mungai and James Kinyangi
Design and Layout: Solomon Makau

Printing: Ecomedia

Photo Credits: Cover page S.Kilungu (CCAFS) From Left to Right Pg ii. S.Kilungu (CCAFS) iii. S.Kilungu (CCAFS) 3. S.Kilungu (CCAFS) 4. J.Mango (ICRAF) 7. S.Kilungu (CCAFS) 9. E.van D Grift 11. P.Kimeli (CCAFS) 13 V.Atakos (CCAFS) 15 S.Kilungu (CCAFS) 17. S.Kilungu (CCAFS) 18. V.Atakos (CCAFS) 20. S.Kilungu (CCAFS) 21. C.Schubert (CCAFS) 23. CIAT 25. V.Atakos (CCAFS) 26. C.Schubert (CCAFS) 29. C.Schubert (CCAFS) 31. S.Kilungu (CCAFS) 33. S.Kilungu (CCAFS) 34 S.Kilungu (CCAFS) and P.Kimeli (CCAFS) Back Page V.Atakos (CCAFS)

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Message From
The Program Leader

We are pleased to share the eighth issue of the SmartAG Partner - CCAFS East Africa quarterly newsletter.

We present initial results from the Nyando climate-smart villages in Kenya where the number of households eating one or no meals a day has reduced. Through a Nature commentary, read how various adaptation measures have brought this change. Also, find out how these lessons reach policy makers through learning visits to the villages.

Many countries rely on default emission factors provided by the Intergovernmental Panel on Climate Change (IPCC) to make their greenhouse gas assessments. Read how a new state-of-the-art lab will enable accurate estimations in Kenya. Additionally, read through two recently published CCAFS working papers: Integrating indigenous knowledge with scientific forecasts in Lushoto, Tanzania - Working paper 103 and Agricultural adaptation and institutional responses to climate change vulnerability in Ethiopia - Working paper 106.

From the field, we profile women farmers who are breaking gender barriers and taking the lead on climate-smart agriculture (CSA). Also read how community based organizations are promoting adoption of CSA practices in Kenyan drylands.

Dr. James Kinyangi

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Exploring targeting options for climate-smart agricultural investments in Kenya

CCAFS together with CIFOR and ILRI are developing an approach to support decision making processes that target appropriate climate-smart agricultural interventions in Kenya and ultimately Africa.

By Patric Brandt, Catherine Mungai and Mariana C. Rufino

Agriculture is the main source of income for the Kenyan economy. According to the Kenya Economic Report (2013), the sector accounts for about 26 per cent of Kenya's Gross Domestic Product (GDP) and 27 per cent indirectly through linkages with other sectors such as manufacturing and distribution. The country's population has been on a sharp increase, yet the agriculture sector has not been growing at the same rate. Almost 20 per cent of the population in the country receives food aid and is at constant risk of starvation.

Climate change has added to the many challenges facing the agriculture sector thereby hampering its growth. In 2013, the Kenya National Climate Change Action Plan (NCCAP) put together by a number of stakeholders was launched in an effort to adapt to and mitigate climate change effects. Additionally, the plan would improve the country's ability to take advantage of the opportunities that climate change offers.

The NCCAP identifies priority adaptation actions per sector. For agriculture, these include targeting and implementing specific climate-smart adaptation actions that include promotion and bulking of drought tolerant traditional high value crops; water harvesting for crop production; index-based weather insurance; conservation agriculture; agro-forestry; and integrated soil fertility management.

However, the implementation of CSA practices on a national scale requires accurate prioritization of climate-smart investments that is evidence based to ensure maximum productivity from selected project areas. The CGIAR Research Program on Climate Change, Agriculture and Food Security East Africa (CCAFS EA) is collaborating with the Center for International Forestry Research (CIFOR) and the International Livestock Research Institute (ILRI) to develop and test a decision support framework that will facilitate the identification and prioritization of suitable CSA projects on a national scale.

Methodology in the framework

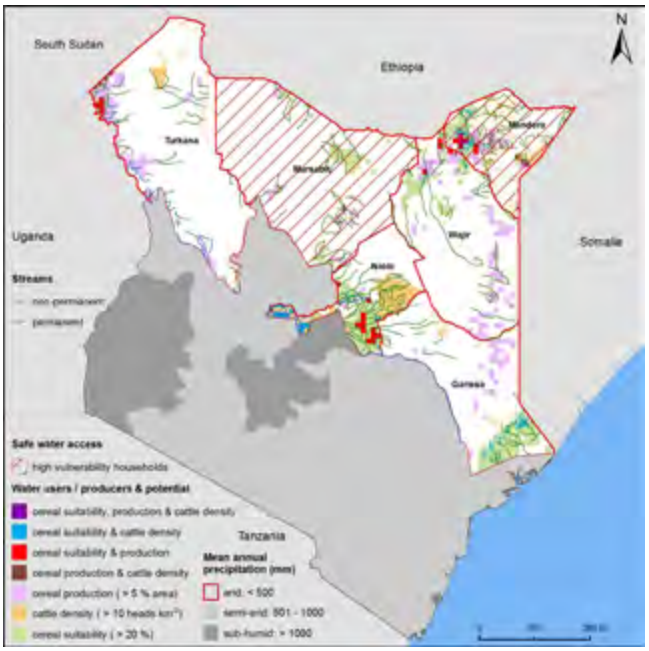
Initially, a taskforce comprising stakeholders from government, private sector, universities and non-governmental organizations was formed to identify the critical parameters that build the basis for developing the decision support framework. These parameters include the integration of relevant quantitative information and stakeholder opinions, spatial targeting of relevant regions, and the consensus-oriented support of decisions.

A database containing quantitative and spatialized biophysical, livelihood and economic vulnerability variables and proxy data for CSA practices has been developed. This data was collected from publicly accessible sources and Kenyan governmental institutions.

Basically, the framework aggregates all the opinions of the different expert groups involved in the planning process and combines these with related spatial information from the

database. Thereby ideal regions for CSA practices in question are proposed. One of the advantages of the framework is the increased level of consensus on where to target a project that implements specific CSA practices.

The framework takes into account biophysical, social and economic data to inform an assessment of where specific CSA practices are needed to reduce vulnerability by improving adaptation and mitigation capabilities. For instance, by applying spatialized vulnerability indicators, such as access to water, markets or gender equity in economic activities, we are able to identify counties whose agriculture is more susceptible to climate change, hence, showing a higher demand for certain CSA intervention practices.



CSA-targeting example using different data on precipitation and water issues to show the demand & potential for CSA-practices on drought tolerant cereal crops and water harvesting & management

Exploring and validating the results

To test this framework, a survey was conducted with 32 experts (of which 15 were female) drawn from cross-sectoral stakeholder groups to capture preferences on indicators of climate change vulnerability and CSA practices. Following the survey, consensually weighted indices of climate change vulnerability and CSA suitability were created based on a multi-criteria decision-making (MCDM) model. This allowed us to identify specific areas of high CSA potential in Kenya — regions with high climate change vulnerability and high suitability for included CSA practices.

The survey results were presented at a stakeholder workshop held in November 2014. During the workshop, a validation survey was conducted and mixed group discussions on ranking the indicators and CSA options were done. The aim was to investigate differences between consensus derived from the model and those from group interactions. It emerged that experts changed their opinions, to some degree, resulting in shifts of high CSA potential regions. One reason for that could be that stakeholders got new information in the meantime or were influenced by opinion leaders during the group discussions. Yet, some of these regions remained the same as in the original survey (potentially interesting for decisions on targeting CSA). In addition, an example was elaborated using the various information from the database and model results on stakeholder opinions. This CSA-targeting example focused on precipitation and lack of safe water sources as important vulnerability indicators as well as drought tolerant cereal crops, and water harvesting and management as prior CSA practices.

Way forward

In conclusion, created spatial indices could be used to inform decisions in CSA-targeting processes for Kenya. Changing expert opinions showed that experts needed to be more thoroughly integrated and surveyed iteratively. In 2015, the team working on the framework plan to apply it on a specific project identified with input from the government of Kenya. This will test the robustness of this approach and its effectiveness in identifying CSA practices and investments. The success of the project will see it implemented in other East African countries and then to the wider African region as a tool in CSA prioritization on national scales.

Read more: Climate action in Kenya: New national plan launched: http://bit.ly/1HrKdBr
Read more about Climate-Smart Agriculture Prioritization Framework: http://bit.ly/19eSCZU
Simple yet comprehensive: A Climate Smart Agriculture Rapid Appraisal prioritization tool for outscaling CSA practices: http://bit.ly/1Bnofr4

Patric Brandt is a PhD student working on the project: National and regional partnerships to support integration of climate change in agriculture and food systems. He is based at ILRI. Catherine Mungai is a Policy and Partnership Specialist working with CCAFS. Mariana Rufino is a senior scientist at CIFOR. She is also the lead scientist for the above project. Editted by Vivian Atakos, Communication Specialist- CCAFS East Africa

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Inspiring action: Nyando climate-smart villages host policy makers

A group of farmers is reaching out to policy makers in Africa, sharing with them lessons from their journey to attaining food secure households.

By John Recha

In November 2013, Rachel Kyte, the World Bank Group Vice President and Special Envoy for Climate Change visited the Nyando climate-smart villages in western Kenya. Rachel observed first-hand what smallholder farmers working closely with researchers and other partners are doing to move out of poverty and build resilience, as well as to find ways to reduce emissions from agriculture.

Since the visit in 2013, Nyando farmers have continued to host a number of people, among them policy makers, interested in learning about their climate-smart interventions.

Nyando is one of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) climate-smart villages (CSVs) in East Africa. Working with a mix of partners, CCAFS East Africa is developing the Nyando CSVs to test climate-smart agricultural interventions. The aim is to boost farmers' ability to adapt to climate change, manage risks and build resilience. At the same time, the hope is also to improve livelihoods and incomes and, where possible, reduce greenhouse gas emissions to ensure solutions are sustainable. Nyando is in an area that has been identified as high at risk from the effects of climate change.

Sharing lessons: Climate-smart interventions

In 2014, 13 officials from the Ethiopian government visited the Nyando CSVs.

The officers included specialists and experts on livestock and crops, soil fertility management, monitoring and evaluation, post-harvest technologies and processing and directors of regional bureaus of agriculture. The tour was organized by the USAID- CIAFS (Capacity to Improve Agriculture and Food Security Project) in order to provide the officers an opportunity to explore how appropriate climate-smart agriculture (CSA) practices in the Nyando community can be replicated and scaled out in Ethiopia.

World Bank's Rachel Kyte during a visit to the Nyando climate-smart villages

Policy makers from Ethiopia wanted to learn which climate-smart practices in the Nyando area can be replicated in their own country. The picture above shows a solar panel used to provide energy for pumping irrigation water.

Farmer John Obuom and his wife Poline talked to the delegation about their diverse one hectare farm, on which they plant vegetables and legumes. Additionally, they keep sheep, goats and chicken to boost the family's food supply and nutrition. The farm is located in a place where land is scarce and much of the existing area has been degraded by floods that carry away top soil leading to loss of productive soil and the formation of deep gullies. Having restored a large part of the previously degraded land, this family is harvesting rain water by directing it to four water pans with capacities ranging from 70,000 to 90,000 litres for irrigation during the dry season.

John practices intercropping of food crops and fruit trees to maximize land use (pawpaws, tomatoes and local vegetables). In the past, he worked with the CGIAR's World Agroforestry Centre (ICRAF) to restore his degraded land. Using species screened through on-farm research, he established tree woodlots to control soil and water movement and rehabilitate previously degraded areas for crop production. He is now able to supply seeds and seedlings to other farmers and his woodlot ensures that he is on the way to complying with the Kenya government policy requiring each farmer to establish 10% of their land holding with trees. In addition, he is a good example amongst farmers who are

ready to participate in Nationally Appropriate Mitigation Action (NAMA) programs.

As a food security measure, he is working with researchers to test and multiply cassava planting material developed in collaboration with the International Institute of Tropical Agriculture (IITA) that resists the deadly mosaic virus disease. He also grows the early maturing pigeon peas as a protein supplement. Pigeon pea is a new crop in Nyando.

Mr. Obuom has also diversified into better adapted breeds of small livestock to meet food security and income needs of his household. He is one of the farmers working with the International Livestock Research Institute (ILRI) to test sheep and goat breeds that will better adapt to changing climatic conditions in Nyando. These include Gala goats which mature and reach market weight faster than indigenous stock of East African goats and Red Maasai sheep that tolerate heat and internal parasites. He now has over 10 goats. Many other farmers have benefited through a 'passing on the gift' initiative introduced by CCAFS and World Neighbors where farmers receive Gala goats for crossbreeding with the small East African indigenous goats. The offspring (six month to one year) are given to other neighbors for purposes of crossbreeding, ensuring everyone in the village benefits.

Stop two: greenhouse farming with youth groups

Visitors to Nyando always encounter youth groups practising smart farming in half hectare fields. The Ethiopian delegation visited the Lower Kamula Youth Group. Here, they learnt how to deal with the challenges of degraded land, declining land sizes and seasonal rainfall variability though adoption of smart farms. A key feature of smart farms is the shift to greenhouse farming (enclosed spaces of up to one quarter of a hectare, covered with polythene and combined with drip irrigation lines). Compared to open fields, greenhouses offer the advantage of use of less water, better control over pests, diseases, floods and drought. Next to the greenhouse, the youth group had established two water pans with a total capacity of over 250,000 litres having over 2,000 tilapia fish. Additionally, crops such as kales, cowpeas and black night shade were planted under drip irrigation.

The smart farms serve as demonstration sites for youth and women groups engaged in agriculture. Due to the nature of the intensive knowledge and skills required to operate greenhouse production units, CCAFS partners train youth groups as part of the process of advancing local adaptation actions. Jack Awuor explained to the visitors:

Onyuongo youth group has two water pans with a capacity of over

"Before establishment of the smart farm, our members were involved in sand harvesting from the adjacent River Asawo which accelerated expansion of gulleys and degradation of riverine vegetation. Now we have tomatoes in the greenhouse and other vegetables in the open field. The fish provide an additional source of income."

Stop three: Empowering the villagers through community based organizations

At a third stop, the visitors got an opportunity to better understand the role of Community Based Organizations (CBOs) in helping farmers increase their capacity to adapt through collective action. Edward Ouko, a farmer and CBO leader explained how an innovation fund had helped establish a farm input supply shop. The CBO partnered with a local agro-dealer, bringing improved seeds and fertilizers closer to the farmers.

Researchers, farmers and government officers working in Nyando and other CSVs continue to monitor and evaluate the various enterprises with an aim to scale up and share emerging lessons widely. In 2015, more learning visits will be held. This includes a visit by officers from the Ministry of Agriculture and Animal Resources in Rwanda working under the IFAD supported Climate Resilient Post-Harvest and Agribusiness Support Project.

Read more on empowering a local community to address climate risks and food insecurity in Lower Nyando, Kenya: http://bit.ly/1N0xaXO

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3

In an important first for Africa, climate data 'Made in Kenya'

The first research center of its kind in Africa is expected to generate more cost-effective and precise greenhouse gas (GHG) emissions measurements for Kenya. Even better: It could lay the groundwork for other similar efforts across the continent.

By Joan Baxter

The Mazingira Center—named for the Kiswahili word for "environment"—in Nairobi is already churning out data on GHG emissions. Until now, Kenya—like most developing countries—has had to rely on default emission factors provided by the Intergovernmental Panel on Climate Change (IPCC) to make its biennial reports on emissions and removals of GHG in the country for the United Nations Framework Convention on Climate Change (UNFCCC).

East African countries did not have the sophisticated equipment needed to measure actual greenhouse gas emissions from different land uses and in different scenarios, and so had to rely heavily on mostly foreign—and generally costly—consultants to perform these calculations for its greenhouse gas inventory. GHG inventory is a key element in national communications with the UNFCCC.

But there's more than pride and money at stake when it comes to calculating homegrown measurements: Early returns show that Mazingira's measurements are more accurate—and thus vastly more useful—than what the country had been using before.

The state-of-the-art lab enables scientists to measure emissions from a full range of sources in Kenya, including livestock; manure management systems; smallholder farms; and land uses such as forests, tea and timber plantations.

A boost for emissons reporting

This is especially good news to Charles Mutai, Deputy Director of Kenya's Climate Change Secretariat and the person in charge of reporting his country's greenhouse gas inventory to the UNFCCC.

> "Calculation of the emission factors and greenhouse gases from livestock is a very, very good initiative down here in Kenya," he said. "It's a first in Africa … and I am happy that it came at the right time, just when we are preparing our national reporting application to UNFCCC, which will inform the Paris 2015 climate agreement."

The research and data being produced at the Mazingira lab is the result of collaboration between the Center for International Forestry Research (CIFOR), Germany's Karlsruhe Institute of Technology (KIT) and the International Livestock Research Institute (ILRI), which hosts the lab.

"I'm excited that there are facilities that can help our greenhouse gas reporting system and also our general reporting to the UNFCCC," said Stephen King'uyu, who is acting Deputy Director for Mitigation and Adaptation in Kenya's Climate Change Secretariat in the Ministry of Environment, Water and Natural Resources, after his first tour of the lab. "This means we can shift from using default values (for emission factors) to values that are a lot more representative of our national circumstances."

Kenyan policy makers from the Ministry of Environment Water and Natural Resources (MEWNR) in the Mazingira lab at ILRI to learn about ongoing GHG measurement work.

Early returns

Early results from the Mazingira lab suggest that the actual emissions from manure in Kenya may be substantially lower, by a factor of four, than the default emission factors currently being used for Kenya. According to ILRI / KIT scientist Klaus Butterbach-Bahl, such discrepancies in actual versus default emission factors can go either way—that is, a greenhouse gas inventory for Kenya done using Tier 2 emission factors (a more complex mix of default and locally specific data) could wind up being lower or higher than what is currently being reported to the UNFCCC.

However, in the global efforts to tackle climate change, what is important is the accuracy of data on emissions, and that can only be improved with quality data collected and analysed locally.

According to King'uyu, the data produced in Kenya on greenhouse gas emissions from different land uses and livestock may also be useful for neighboring countries that share similar geophysical and socioeconomic features in calculating their greenhouse gas inventories. He also noted that in the future, with such calculations being made using samples and data produced locally in the Mazingira lab, Kenya may be able to save money on expensive foreign experts currently engaged for this work.

"Other countries in the region look to Kenya to set the pace," he added. "And this is what we will be able to do when we can calculate our own GHG emission inventory."

Training ground

CIFOR scientist Mariana Rufino sees the climate change work being done in Kenya as part of an effort to provide Kenya with support for its National Climate Change Action Plan, drawn up in 2013. In addition to the crucial data that can be produced and analyzed thanks to the sophisticated equipment in the lab, which she said can improve the quality of data and thus the greenhouse gas inventories, it will also provide an extremely important training ground for young technicians and scientists from Kenya and elsewhere in Africa. Already there are 20 students and technicians from Kenya and eight other countries working in the lab and on the projects using its facilities to produce data and analyze samples.

The Mazingira facility in Nairobi is just the beginning, Rufino says. The intention is that it will eventually become a central hub for environmental excellence in Africa, with a network of smaller satellite climate change laboratories across the continent, the first of which is already up and running in Cameroon.

"CIFOR has expertise in forests and trees so our partners benefit from our forest knowledge," Rufino said. "But we cannot have expertise in everything, so we work with partners to fill the gaps and tackle climate change problems.

"Our partners in Kenya are also interested in how to offset emissions from the livestock sector, and we all know that forests can be one of the best solutions for this."

Read more on GHG: http://bit.ly/1aD3NMR

Joan Baxter is the Communications Officer for CIFOR African region

4

Project takes action for climate-responsive policies in East Africa

The Policy Action for Climate Change Adaptation (PACCA) project is building a more climate-responsive future with policy-makers in Tanzania and Uganda.

By Cecilia Schubert and Naomi De Groot

A targeted approach, with scientists working directly with policy-makers and smallholders finding solutions to agriculture and climate related issues, could be the key to scaling-up climate-smart farming. This is exactly what the Policy Action for Climate Change (PACCA) project, led by the International Institute for Tropical Agriculture (IITA), is aiming for.

The four-year climate project is part of CCAFS Flagship on "Policies and Institutions for Climate-Resilient Food Systems" and has already launched two major Learning Alliances in Uganda and Tanzania.

The Alliance participants include government members, scientists, community-based organizations, private sector representatives and farmers' associations, who share and present interdisciplinary agriculture and climate change research, knowledge, solutions, and experiences.

The approach is to make the meetings as appealing and understandable as possible, so that when people leave, they know which policy actions and climate-smart farm practices are available and useful to adopt.

As part of the engagement activities, the PACCA team is working directly with policy-makers in Uganda and Tanzania to, among many things, support the development of national-level policy frameworks, ensuring climate change and climate-smart agriculture are taken into consideration.

Testing policies against future socio-economic scenarios

By striking up collaboration with CCAFS Future Scenarios team, the PACCA project invited stakeholders to review the National Agriculture Policy and Mechanization Framework in Uganda as well as the new National Environment Policy in Tanzania, testing made assumptions and policies against multiple, all highly potential scenarios for the two countries. The scenarios are used as a 'crash test' to make the policy frameworks more climate-sensitive and robust.

In mid-February participants came for two consecutive national workshops in Tanzania and Uganda. The stakeholders represented the Vice President's Office, Prime Minister's Office, and Ministry of Agriculture, Livestock and Fisheries Development in Tanzania and in Uganda, the Ministry of Water and Environment and Ministry of Agriculture, Animal Industry and Fisheries.

The scenario workshops were conducted the same way as in Cambodia, Honduras and Bangladesh, and were done in collaboration with University of Oxford. The workshops started off with critically reviewing the existing policy frameworks and coming up with a list of recommendations where they could be further strengthened.

The participants were then introduced to the "scenario worlds", worlds were the sleepy lions, lone leopards, industrious ants and herds of zebras live. These worlds, or potentials-scenarios, have been pre-crafted by the scenarios team, based on previous work in East Africa back in 2012.

They combined the scenario storylines of socioeconomic development with climate change scenarios and quantified them for the region using the GLOBIOM model, developed by International Institute for Applied Systems Analysis (IIASA) and the IMPACT model, developed by International Food Policy Research Institute (IFPRI). Providing participants with model outputs, such as figures of per capita calorie availability as well as growth in crop yields for each scenario, builds additional context for the plausible future worlds and allows participants to examine the relative differences between scenarios.

The sleeping lions world illustrates a world with latent capacity and wasted opportunities, with revolutions that lead nowhere, due to lack of regional integration and a reactive government. In world where lone leopards live there is a lot of selfishness. There is still no regional integration, but a proactive government.

Things are looking better in the world according to the industrious ants. High regional integration and a proactive government create a wide range of benefits for food security, even though it is a costly battle that has to deal with corruption. In this scenario there is regional integration, but a reactive mode of governance focussing on industry, tourism, export agriculture, and the likes. There is little emphasis on food security, environment and livelihoods.

Entering these worlds enables participants to see if their policies will be effective under different socio-economic scenarios and if they are robust enough to withstand outlined challenges.

After the first workshop was held, PACCA Project Leader Edidah Ampaire said: “I am happy to see that after only two days of scenario development, stakeholders were critically reviewing every section of their framework, coming up with multiple improvements and recommendations.”

“I think we made significant progress towards shaping more flexible and climate-responsive policies,” she continued.

Fredrick Ssozi, Assistant Commissioner on agricultural mechanization from the Ministry of Agriculture, Animals, Industry and Fishery in Uganda commented:

“This exercise has been a real eye-opener. In the beginning I wasn’t sure where we were going with all of these different worlds, but once I got it, I saw how useful they were to further strengthen the framework.”

Tanzanian policy makers came together for a workshop from 16 - 17 February 2015 in Morogoro, Tanzania. The meeting focussed on scenario-guided policy development in the context of climate change that will enable them to further improve Tanzania’s New Environmental Policy

“We should perhaps have invited more and different stakeholders to the workshop, and also made sure to include other departments! This would help ensure planning is long-term and incorporate more uncertainty into our work,” he added.

Next steps

The ministries are currently revising their Development Strategy and Investment Plan together with the PACCA team, using the scenario-based recommendations to further improve the ministries’ new policies. The two teams will closely collaborate with the policy-makers to update the policy frameworks in accordance with the scenario-based recommendations

For the PACCA team, the scenario follow-ups will be done in parallel with all other project activities. Gathering stakeholders from various communities, conducting field-research and engaging with smallholders, and strengthening collaboration with key policy-makers across ministries are all key activities for the project team.

Read more on policy work: http://bit.ly/1yAORdF
Creating future scenarios to review policies in Uganda and Tanzania: http://bit.ly/1JaNRwV

Cecilia Schubert works as a Communication Officer for CCAFS Flagship on “Policies and Institutions for Climate-Resilient Food-Systems”. Naomi de Groot works as Communication Consultant with the Policy Action for Climate Change (PACCA) project with the International Institute for Tropical Agriculture (IITA).

5

Policy makers from Rwanda learn about community adaptation experiences

How can research on climate-smart agriculture inform investment decisions of national governments? See how policy makers are learning from research initiatives of farmers and partners in Western Kenya.

By Philip Kimeli, Thomas Mawora and John Gathenya

The number of hunger months experienced by families in the Nyando climate-smart villages in Western Kenya is falling. This has been attributed to a number of innovative climate risk management and adaptation strategies taken up by these farmers working closely with other partners for the last two years. Emerging lessons are being shared widely with stakeholders, among them policy makers.

From 30th March - 3rd April, a team from the Ministry of Agriculture and Animal Resources in Rwanda undertook a learning visit to the Nyando CSVs to learn from ongoing initiatives. These officers are working under the International Fund for Agricultural Development (IFAD) supported Climate Resilient Post-Harvest and Agribusiness Support Project being implemented in Rwanda. This project aims to alleviate poverty, increase the incomes of smallholders and rural labourers – including women, youth and vulnerable groups – and contribute to overall economic development in Rwanda.

"We are interested to learn how collaborative efforts with the Kenya Meteorological Service (KMS) have helped develop downscaled seasonal climate forecast information and how to effectively communicate this information to farmers. Additionally we want to see how best to partner with local communities in order to enhance their adaptive capacity to climate change and variability "said Madeleine Usabyembabazi, Climate and Environmental Specialist, from Rwanda.

Climate risk management in Nyando, Kenya

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) East Africa together with Maseno University and other partners have been providing climate information services to Nyando farmers at the local level.

"The climate information services have three components which include holding pre-season seasonal climate outlook meetings, sending short-message-services of the weekly forecast and preparing products explaining crop-climate interaction for the region" says, Thomas Mawora, a climate scientist from Maseno University.

The team has used climate and crop models to analyze climate data and prepare the information to disseminate.

Historical climate information

The analysis of long-term historical rainfall data to generate products such as graphs of total seasonal rainfall, number of rainy days and start of season for different years was shared. "We engage farmers in working groups for analysis and discussion of the historical rainfall data. This way, farmers get to appreciate variability in the different aspects such as start of rains and the seasonal totals" explained John Gathenya, one of the partners in this project based at the Jomo Kenyatta University of Agriculture and Technology (JKUAT).

Climate-smart farmer Eddy Ouko (left) explains to policy makers how and why he collects rainfall information on his farm.

The Rwandese delegates further learnt how farmers collect, record and manage the rainfall data using rain gauges erected on their farms. Since this data showed a lot of variability, between both nearby farms and the further KMS meteorological station, downscaled products had to be developed for precision in the forecasting that would help reduce the risk of crop failure.

Partnerships and dissemination of climate data

The visitors also learnt how the climate outlook was summarized and presented to farmers. Discussions showed that with a proper strategy, disseminating weekly forecasts to target farmers would help many prepare for in-season shocks or opportunities at a very low cost. Already, Maseno University has sent out over seven hundred weekly messages - seven day forecasts - which farmers use in making farm decisions. Furthermore, extension officers from the Ministry of Agriculture, Livestock and Fisheries (MoALF) regularly meet farmers to discuss climate challenges they are facing in their farming activities.

Nyando's smart farms

During a visit to Kapsokale Community Based Organization smart farm, the guests met youth groups farming on half hectare fields. Interventions included rainwater harvesting, conserving soil fertility and organic components, green house farming and crop diversification to reduce risks associated with climate change. These farms serve as demonstration sites for youth and women groups engaged in agriculture. Due to the nature of the intensive knowledge and skills required to operate the greenhouse production units, youth groups are trained as part of the process of advancing local adaptation actions.

In conclusion, researchers, farmers and government officers working in Nyando and other CSVs continue to monitor and evaluate the various enterprises with an aim to scale up and share emerging lessons widely. Currently, training manual on participatory approaches for use of climate information services by farmers is being developed in collaboration with the University of Reading. This manual will be ready later in the year.

Read on how can we help farmers better understand climate information?: http://bit.ly/1NWDPpX

Phillip Kimeli is a Research Assistant with CCAFS East Africa, Thomas Mawora is a Tutorial Fellow at Maseno University, Kenya, John Gathenya is a Climate Change Research Fellow at the Walker Institute for Climate System Research.

6

Climate adaptation effort cuts hunger in African villages

Shift in farming techniques reduces number of households eating one or no meals each day in the Nyando basin, Kenya.

By Natasha Gilbert

Feeding the projected 9 billion people in 2050 requires a radical transformation of agriculture. Since 2011, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) East Africa, together with partners such as International Livestock Research Institute (ILRI) and the International Potato Centre (CIP), development organizations and local government have been working with smallholder farmers in Africa towards a shift in farming techniques that include improved crop varieties and resilient livestock breeds. Initial results point to a reduction in the number of households eating one or no meals a day. Read more from this Nature news commentary published in the run up to the CSA Global Conference held in March 16 - 18.

An ambitious project to help smallholder farmers to adapt to climate change has significantly reduced hunger at test sites in East Africa. In seven villages in Kenya, for example, the number of households that experience at least two months per year with one or no meals per day fell by roughly 60 percentage points over a period of four years.

The African sites are part of an effort to turn villages on five continents into labs, testing new farming techniques, crop varieties and livestock breeds to improve food security in the face of climate change. Run by the CGIAR, a global partnership focused on agricultural research for food security, the project presented initial results from its 22 'climate-smart villages' at a conference in Montpellier, France, on 16–18 March 2015.

Krystyna Swiderska, a researcher in agricultural and biodiversity at the International Institute for Environment and Development in London, says that climate change is already affecting farmers in developing countries, creating a clear need for better information and resources to help them to cope. "Those areas that are already finding it hard to produce food will be worst affected by climate change. More erratic rainfall and greater incidence of pests and disease is making it harder to grow food," she says.

One of the longest-running test sites is a set of seven villages in the Nyando district of Kenya. There, the latest data show that the number of households eats just one or even no meals per day is falling. When 139 households in the area were surveyed in 2010-2011, 81% experienced up to two such 'hunger months' per year; that has since dropped to just 23%. And 3% of the households now have food year-round, compared to 1% in 2010-2011.

"The amount of food farmers are able to produce and consume is growing. The extra crops are filling that food deficit," says James Kinyangi, who leads the CCAFS project in East Africa.

Farmers in the 22 test sites pick from a portfolio of approaches to help them to adapt to their individual environmental challenges, such as improved seeds or better access to fertilizer. The farmers also participate in research studies, such as testing whether growing legumes such as the pigeon pea

New seed varieties and planting techniques have helped to reduce hunger at test farms in Kenya.

(Cajanus cajan) in addition to staple crops such as maize (corn) can improve food security.

When the project began in Nyando, just 32% of households grew 'improved' crop varieties, and just a handful of farmers used inorganic fertilizer. Then CCAFS and partners helped to make fertilizer and drought- and pest-resistant seeds accessible to the farmers through a nearby input shop. By 2013, the average annual use of fertilizer had risen to 16 metric tonnes. And by 2014, around 92% of the 340 households surveyed were growing improved seed varieties.

Learn more about Nyando: http://bit.ly/1PXnj7u
Read the full story on Nature here: http://bit.ly/1BBtnwp

This story was originally pubished on nature.com

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7

Reducing the environmental impact of a rapidly growing livestock sector

Livestock Nationally Appropriate Mitigation Actions (NAMAs) aim to enhance productivity and efficiency while also reducing environmental impact. A synthesis of the state of play of livestock NAMAs across the globe is now available.

By Suzanne Van Dijk, Timm Tennigkeit, Andreas Wilkes

Livestock is a source of nutrients from meat and dairy and contributes significantly to livelihoods, directly supporting smallholder farmers and creating employment. Livestock also provides power through animal traction, manure to fertilize future crop production and security by acting as a kind of insurance.

And with expected growth of the world population, growing prosperity and urbanization, the expected increased demand for animal-source foods will cause profound growth in the livestock sector. While this expected growth will create opportunities, it may also result in adverse and long-lasting negative environmental impacts. Currently, the sector uses a large share of the global surface area, contributes to degradation of land and forests, causes pollution and emits approximately 14% of all human-induced greenhouse gas emissions.

A new CCAFS working paper, Climate-smart livestock sector development: the state of play in NAMA development, sheds light on key elements in the development of Nationally Appropriate Mitigation Actions (NAMAs) within the livestock sector. The authors, from UNIQUE Forestry and Land Use, find that the sector can enhance productivity and efficiency while also reducing environmental impacts.

Why prioritize mitigation activities in the livestock sector?

Synergies between livestock development and mitigation ofgreenhouse gases provide a timely opportunity to address opportunites and challenges posed by growth in the livestock sector within development and agricultural initiatives. Mitigation approaches can be supported by a vast foundation of knowledge, best practices and technologies. Researchers have found that emissions could be reduced by 18-30% without reducing overall outputs by applying best low emission practices (Gerber et al. 2013).

Most mitigation technologies and practices may also improve productivity and contribute to food security and poverty alleviation. For example, mitigation activities may include increasing production efficiencies – by reducing emissions per livestock product – or shifting production-related investments towards less emission-intensive feed.

NAMAs: What are they and how are they related to agriculture?

Within the United Nations Framework Convention on Climate Change (UNFCCC), NAMAs are mitigation actions undertaken to support national sustainable development, to be implemented with domestic or international support in financing, technology or capacity building. Although the NAMA concept was first introduced at the United Nations Conference of

Growth in the livestock sector provides opportunities to improve livelihoods while adapting to become climate-smart

Parties in Bali in 2007, progress in implementation - across sectors - has been slow.

In the context of Intended Nationally Determined Contributions (INDC) covering mitigation and adaptation targets as well as the means of implementation (finance, technology transfer and capacity building), support for sectoral NAMAs is expected to increase. The agriculture sector is striving to increase awareness of the relevance of mitigation and improve reduction and monitoring of non-point emissions across many individual farms - necessary preqrequisites to agricultural NAMAs.

Within the agricultural sector, livestock NAMAs hold promise due to sector dynamics, substantial investments and relatively well organized sub-sectors. Already, mitigation activities within the livestock sector are becoming increasingly important in many countries' NAMAs.

Looking Ahead

Given the projected increase in the demand for animal-source foods in developing countries and trends in livestock emissions and other environmental impacts, there is an urgent need for transformational change in livestock production.

By developing NAMAs that focus on the livestock sector, there is a large potential for climate-smart agriculture to increase production, climate resilience and animal welfare while also reducing emissions.

Authors of the working paper conclude that though challenges remain, livestock NAMAs can promote adoption of climate-smart livestock production systems, provide attractive investment opportunities to reduce the environmental impact of the sector, and also promote food security and enhance local livelihoods.

Access the working paper No 105 : http://bit.ly/1NWHEvn

Suzanne Van Dijk, Timm Tennigkeit, Andreas Wilkes work for UNIQUE Forestry and Land Use

8

Integrating indigenous knowledge with scientific forecasts in Lushoto, Tanzania

Improving food security needs appropriate climate related risk management strategies. Read more on integration and utilization of indigenous knowledge and scientific weather forecasting in Tanzania.

By Vivian Atakos

"We used to grow cassava, coffee, tomatoes, bananas and pumpkins very successfully and without using fertilizers and pesticides. We had bumper harvests. All this has changed; even with heavy investment of inputs, you cannot get a good yield, says Swadakati Said, a farmer from Mbuzii village, Lushoto, Tanzania.

Farming households in many parts of the world, including Africa, are facing huge changes and challenges including continuing high population growth, declining soil fertility and crop yields, poor market access and unpredictable weather patterns. Household food insecurity is a common problem. Improving food security needs appropriate climate related risk management strategies. These include using climate information to guide farm level decision-making. In Lushoto climate-smart villages, farmers have been using indigenous knowledge (IK) forecasts to predict the weather.

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) East Africa, Sokoine University of Agriculture (SUA) and Tanzania Meteorological Agency (TMA) recently undertook a study to promote the integration and utilization of IK and scientific weather forecasting to improve farmer decision-making and management of climate risks. The specific objectives were: to identify and document existing IK in weather forecasting practices; to establish IK weather forecasting zones and teams; and to operationalize the integration and dissemination of IK and scientific weather forecasts.

Findings:
Identification and documentation of existing IK in weather forecasting practices

Indigenous knowledge is often passed on from one generation to the other by the custodians and is not widely documented. Locally observed variables and experiences have been used to assess and predict the local weather conditions in Lushoto. The most common IK indicators in Lushoto are birds (swallows, hornbills, owls, coucals, and golden orioles), animals (baboons, monkeys, and antelopes), insects (thrips, ants, bees, locusts, and butterflies), shrubs and trees. The occurrence of large flocks of swallows and swans roaming from the South to the North during the months of September to November, for example is an indication of onset of short rains.

Majority of the respondents (over 90%) indicated that they were aware of the indigenous weather and climate forecasts, with 83% reporting using IK forecasts in planning their agricultural activities. Most of the farmers (56%) believed that the IK forecasts were reliable compared to 22% for scientific forecasting.

IK weather forecasting groups

Three local IK forecasting groups consisting of seven people for each administrative ward were established. These groups

meet twice a month to discuss and document the IK weather forecast observations. Subsequently, they give two-week weather forecasts twice a month, describing the indicators that they use for forecasts. Apart from issuing new forecasts in their regular meetings, the previous forecast is also reviewed.

Overall, the forecasts from the IK groups were fairly accurate as the review showed that most of the time the IK groups got it right. However, it is important to document the IK forecasts to make better conclusions.

Conclusion and recommendations

This study revealed that lack of documentation and reliability are among the key challenges in using IK forecasts. Consequently, there is need for systematic documentation of IK in order to sustain and improve it for use by future generations. There is need to strengthen IK in weather forecasting, especially due to increasing changes in weather patterns and variability by integrating it with scientific weather information.

The provision of climate information services in Lushoto will be improved through the district consensus weather forecasting team composed of a multistakeholder partnership that involves the local community, agricultural extension services and the TMA. Equally important is the establishment of an information dissemination network that provides information to all farmers beyond the administrative wards, as all the farmers in the district need to manage climate-related risks. This could be achieved by integrating systems for disseminating climate information within the local communities, e.g. through the local schools, community-based organisations, churches in highly religious communities, partnership with NGOs and agricultural input dealers and service providers. Similarly, integration of weather forecasting into the national agricultural policies and District Agricultural Development Programmes (DADPs) would greatly enhance food security, as it would lead to better-informed decisions at farm level. For easier understanding of the forecasts by majority of the farmers, there is need to translate the consensus weather forecasts into the native language.

Local communities in Africa have continued to rely on indigenous knowledge (IK) to conserve the environment and deal with natural disasters

Access the working paper here: http://bit.ly/1FR372k
Read a blog on indigenous knowledge in Tanzania: http://bit.ly/19eWaLR

Vivian Atakos is Communications Specialist with CCAFS East Africa. Working Paper was authored by Henry Mahoo, Winfred Mbungu, Isack Yonah, John Recha, Maren Radeny, Philip Kimeli and James Kinyangi

9

Heat Tolerant, Tough Teeth, Lots Of Milk — They're Supergoats!

A group of farmers is reaching out to policy makers in Africa, sharing with them lessons from their journey to attaining food secure households.

By Natasha Gilbert

Villagers in a rural district of Kenya are getting a helping hoof to adapt to climate change. A newly introduced breed of "supergoat" is cutting the number of months per year that they go hungry.

Galla goats are tough, but loving. They tolerate heat and drought and have great teeth (which means they rarely need to be culled due to worn-down chompers). The goats also produce a lot of nutritious milk and mature more quickly than the old straggly looking breeds that the Nyando farmers are used to keeping. And the females are really good moms, breeding and rearing kids for up to 10 years.

The goats were brought to Nyando by scientists at the CGIAR, a global agricultural research partnership to improve food security. The goats are part of the partnership's "climate smart villages" project, which helps farmers in the developing world adapt to climate change.

Agriculture needs a "radical transformation" to produce more food in increasingly difficult environmental conditions, says Dr. James Kinyangi, who leads the project in east Africa. "Farmers must become more climate smart," he says.

The "supergoats" have become so popular in Nyando that they will replace all the other goats in the area in another 5 years.

Farmers Edward Ouko and Stephen Matinde recently praised the goats at an agricultural fair in Kenya. They told an audience that they like the Galla goats because they mature into adults at around six months — half-a-year sooner than the local breeds. "

That means faster reproductive cycles," say the farmers. More sex means more goats, and more goats means more money. That's why the goats "fetch three times the price" of local breeds at the market, the farmers say gleefully.

The Galla goat is adapted to drylands, has good growth rate as well as milking ability

"I now comfortably pay [school] fees for my children from the sale of the goats," Daniel Langat, another Nyando farmer, told the researchers.

And more money means families aren't going hungry. The goats, along with other climate-smart farming activities, have brought more food to the table in Nyando households. In 2010–11, a survey of 139 households found that 81 percent suffered up to two "hunger months" a year, with families eating just one or even no meals a day. That number has now dropped to 23 percent

Read more on Galla goats: http://bit.ly/1HdV0h8

Natasha Gilbert is a freelance journalist who writes for Nature and other scientific publications

10

Climate-smart agriculture takes root in Africa

As we celebrate Africa Environment day, we highlight Climate-Smart Agriculture and its potential in addressing some of the pressing environmental and developmental challenges facing the continent.

By Vivian Atakos, Sékou Touré and Oluwabunmi Ajilore

"There are opportunities even in the most difficult moments," said Wangari Maathai, the internationally renowned activist acknowledged for her struggle for democracy, human rights, and environmental conservation.

Dr. Maathai frequently narrated her childhood experience: a world where food was present in the farms all year round and birds would chirp as frogs croaked in anticipation of the rains. Today, over 50 years later, Africa is a different place. Climate related shocks such as droughts and floods are more frequent and are altering how people gain access to food, changing the balance between work, trade and transfers.

As we mark the Africa Environment Day on March 3, we highlight climate-smart agriculture (CSA) practices and their potential in improving productivity and livelihoods. Climate-smart agriculture is the result of practices and technologies that sustainably increase productivity, support farmers' adaptation to climate change, and where possible reduce levels of greenhouse gases. CSA can also help governments to achieve national food security and poverty reduction goals.

In Africa, a number of CSA practices have already been trialed and adopted through projects initiated by a number of partners. These include the East African Dairy Development project implemented by Heifer International in partnership with the International Livestock Research Institute (ILRI), TechnoServe, World Agroforestry Centre (ICRAF), African Breeders Service Total Cattle Management, and farmers; Drought Tolerant Maize for Africa coordinated by International Maize and Wheat Improvement Centre (CIMMYT) and the International Institute of Tropical Agriculture (IITA). Others include Conservation agriculture in Malawi and Zimbabwe and the Africa Risk Insurance Mechanism. These initiatives (and many others) have yielded much lessons and are transforming Africa's agriculture into a more sustainable and profitable sector. These are documented in a recent booklet co-published with the Technical Centre for Agricultural and Rural Cooperation (CTA).

Since 2011, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has been working with a number of partners to trial CSA interventions in learning sites referred to as climate-smart villages. These are currently being developed in West Africa: Yatenga in Burkina Faso, Lawra-Jirapa in Ghana, Segou in Mali, Kollo in Niger and Kaffrine in Senegal and East Africa: Borana in Ethiopia, Wote and Nyando in Kenya, Usambara in Tanzania, Albertine Rift in Uganda and the Kagera Basin in Uganda.

8 Million Litres

Is the milk intake per month at dairy enterprises up from 529, 000 in 2008 when the EADD program was launched.

Kaffrine in Senegal and East Africa: Borana in Ethiopia, Wote and Nyando in Kenya, Usambara in Tanzania, Albertine Rift in Uganda and the Kagera Basin in Uganda.

Tools and approaches to make farming climate-smart Uncertainty in weather patterns has left many farmers in Africa vulnerable due to failed rains that impact on crop and livestock production. To address this problem, farmers in Eastern and Western Kenya have constructed water pans to capture surface run-off whenever it rains. Subsequently, they are able to continue farming through small scale irrigation for a period of three months after the rains stop. To reduce the surface run off that robs the soils of important nutrients, the farmers have constructed terraces to slow down the water thereby preventing soil erosion.

Agroforestry

Another practice that can be climate-smart is agroforestry. This entails growing of trees together with crops such as drought tolerant maize and sorghum to stabilize and enrich the soil. A project aimed at halting the advance of the Sahara desert in West Africa through farmer-managed natural regeneration has been carried out for the last 30 years.

200

million new trees have been planted over the last 30 years in West Africa

There has been exponential growth in the number of tree nurseries in Lushoto, Tanzania as farmers have realized the importance of agroforestry. The trees are mainly used in the mitigation of climate change effects and sustainable land management.

Subsequently, farmers have grown 200 million new trees on cultivated fields. In fact, where they had only two or three trees per hectare 20 years ago, they now have 40 to 100 trees or more.

New crop varieties

Increasing temperature has led to an emergence of new pests and diseases that affect the productivity of both crops and livestock. With the help of a number of partners, farmers in Africa can now access drought tolerant, high yielding and locally adapted varieties of maize and sorghum. For instance through the Drought Tolerant Maize for Africa project over two 2 million farmers saw an increase in yields by 10 – 34 %. This project was undertaken in Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe.

In Tanzania, in the Lushoto climate-smart villages established by CCAFS, adoption of improved bean varieties by local farmers led to a threefold increase in bean yield compared to local varieties.

10–34 %

has been the yield increase for over 2 million farmers participating in the drought resistant maize project

The introduction of new crop varieties that are better adapted to climate change has seen farmers reap huge profits across Africa.

Climate information services

To adapt to the whims of a changing climate, it became imperative for farmers in the Sahel to have access to up-to-date climate information. Such information needs to be easily accessible and understandable. In Senegal, West Africa, the National Meteorology Agency (ANACIM) works with the Union of Associative and Community Radio (URAC) to better disseminate climate information to farmers.

Radio is a medium that plays an important role in the dissemination of climate information at the right time, in a clear and accessible language to users. It is in this context that training was organized by ANACIM to better equip radio professionals. The goal was to ensure that climate information was disseminated to target users in a format that is useful.

The combination of scientific weather forecasting and indigenous knowledge has helped farmers plan better across Africa

Policy initiatives

African countries need a sustainable dialogue forum for experts and policymakers to agree on a shared vision of research priorities and translate findings from researchers into policy decisions.

To better integrate climate change component into decision making processes, platforms for exchange between researchers and policy makers are set up in West and East Africa. This is particularly the case in Mali where the national platform has published a working paper on the analysis of the challenges, constraints and opportunities of climate change adaptation. In East Africa, CCAFS is working with policy makers to support countries for early action on CSA. This includes identification of priority actions within climate change plans informed by CCAFS tools: Climate Smart Agriculture Rapid Appraisal (CSA-RA) Prioritization Tool, Climate Analogues and Atlases of learning sites (CSVs) Climate and Agriculture Network for Africa (CANA)

Climate and Agriculture Network for Africa (CANA) Through a recently launched regional web-based platform, we aim to bridge the gap between science and policy makers to address climate change, agriculture and food security issues in Africa. CANA facilitates national level dialogue by providing a platform for consolidating national climate change, agriculture and food security policies. The platform will create an avenue for learning and sharing knowledge on climate-smart agriculture (CSA) programs, National Adaptation Plans (NAPs), National Adaptation Programmes of Action (NAPAs), Nationally Appropriate Mitigation Actions (NAMAs) among others.

At the regional and continental levels the platform will focus on building the capacity of the African Group of Negotiators (AGN) to integrate agriculture into climate change issues under the United Nations Framework Convention on Climate Change (UNFCCC) through sharing of evidence. While the platform mainly targets policy makers, it will also serve researchers, non-governmental practitioners, private sector including farmers' organizations by enabling them to share and access information on Africa's agriculture in the context of a changing climate.

After all, climate change is a complex problem requiring all stakeholders to come together. And as the science research community meets in Montpellier, France from March 16 for the third Global Science Conference "Climate Smart Agriculture 2015", all stakeholders, policy makers included, should be ready to take up key recommendations for a food secure and peaceful world.

Read more on exploring targeting options for climate-smart agricultural investments in Kenya: http://bit.ly/1NWJtZd
Read the blog: In Kaolack, community radio broadcasters help spread climate information: http://bit.ly/1yAV4Gt

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11

Gender divisions and climate variability are hindering a climate-smart East Africa

A trial conducted in several east African villages, using Climate-Smart Agriculture Rapid Appraisal, identifies two major challenges to agricultural productivity: climate variability and gendered division of labour.

By Caroline Mwongera

Climate-smart agriculture (CSA) has been promoted as an option with many benefits. It is expected to increase agricultural productivity and income in a sustainable way, but also to make farming systems more reslient to climate change, while reducing greenhouse gas emissions. The question then is: How can CSA become mainstream practice in the bio-physically and socio-economically diverse environments that characterize East Africa's smallholder farming systems.

With this question in mind, the International Center for Tropical Agriculture (CIAT) and partners developed a Climate-Smart Agriculture Rapid Appraisal (CSA-RA) tool, for prioritizing CSA across diverse landscapes.

Read more here: Simple, yet comprehensive: A Climate-Smart Agriculture Rapid Appraisal prioritization tool for outscaling CSA practices

The (CSA-RA) tool has already been tested in four districts in northern Uganda (Gulu, Nwoya, Kitgum, and Adjumani) and in the Southern Agriculture Growth Corridor of Tanzania (Kilolo, Kilosa, Bagamoyo and Mbarali).

Challenges facing farmers in Uganda and Tanzania

The first steps in targeting CSA are to understand the existing agricultural challenges and to identify the benefits of introducing appropriate technologies. The CSA-RAs in Uganda and Tanzania identified climate variability as a great challenge in agriculture production. In particular, farmers pinpointed unreliability of the onset and cessation of the rains, uncertainty about the duration of the rainy season, occurrence of too much rainfall, and droughts. Both male and female farmers reported an increase in pests and diseases associated with too much rainfall, water scarcity, famine, loss of crops and livestock.

Already, farmers have adaptation options which include charcoal burning, brick making, sale of livestock, engaging in small businesses, irrigating crops along valley bottoms and dependence on remittances from their kin working in urban centers. A strong concern among women is that men often adapt by migrating to urban areas and abandon their families to seek paid employment.

Gender and CSA implementation

As one might expect, gender impacts on views of climate variability. In Tanzania's Kilolo district, for instance, women and men described weather events and impacts that had occurred in previous years in different ways.

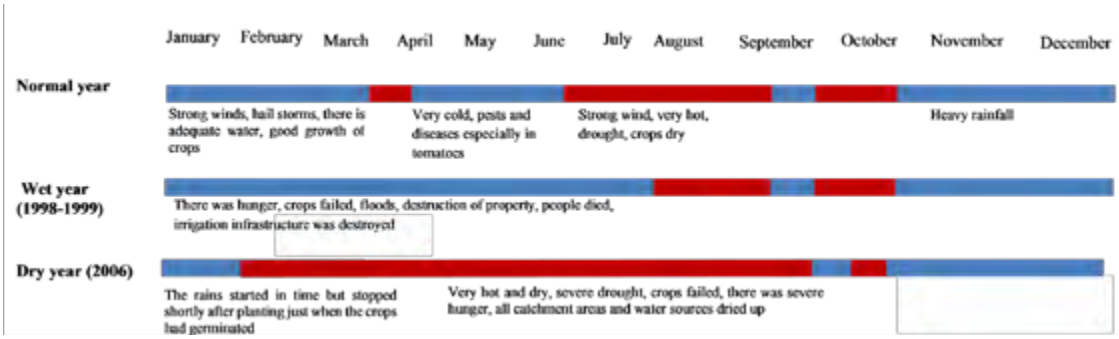
Cropping calendars by traditional gender groups revealed differences in the division of labor in terms of both crops

and livestock. Marketing of agricultural produce is mainly considered a man's activity as women are perceived to be poor negotiators and deemed unable to effectively source for markets. This suggests that there is a need for empowering women with negotiating skills and market information.

Institutional mapping with Venn diagrams also indicated gendered differences in resource and information flows. These data are vital to recognize key institutions and entry points for men and women.

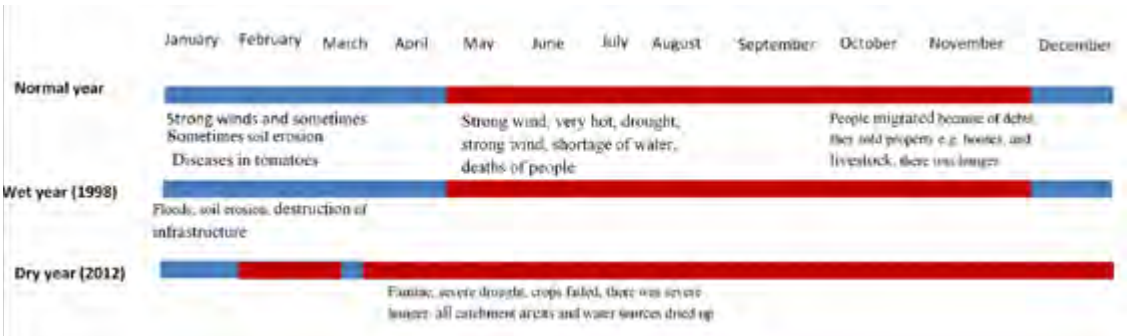
In conclusion, using the CSA-RA tool enables prioritisation of climate-smart agriculture with an understanding of gendered challenges, priorities, perceptions and impacts.

Kilolo Women

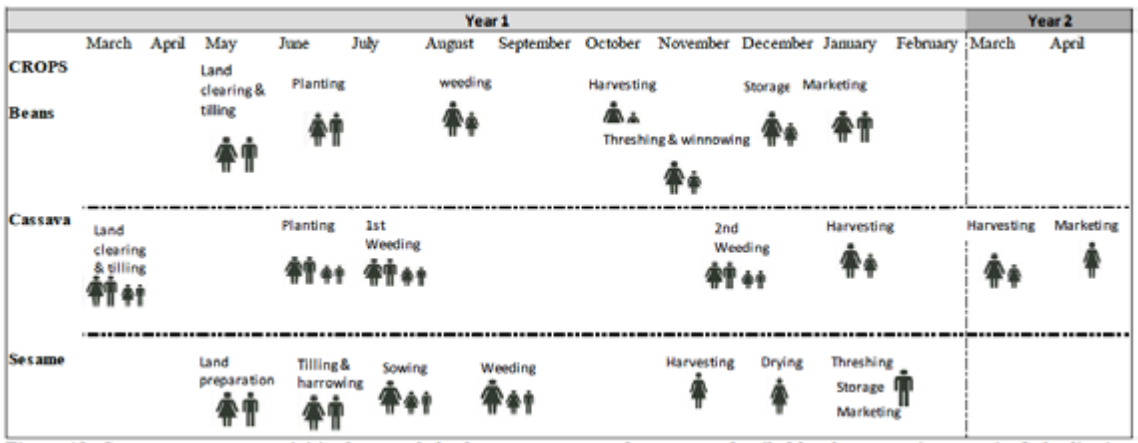


Normal, wet (1998) and dry (2006) years, as perceived by female farmers of the Kilolo district in Tanzania

Kilolo Men



Normal, wet (1998) and dry (2012) years, as perceived by male farmers of the Kilolo district in Tanzania



Example of a cropping calendar developed during the CSA-RA. Crop management activities by month for beans, cassava and sesame as detailed by the women's group in Gulu district. Logograms indicate whether men or woman undertake the activity.

Learn more about the tool: http://bit.ly/1IlTrfP

Caroline Mwongera is a Postdoctoral Fellow at CIAT - Kenya. Leigh Winowiecki, Kelvin M. Shikuku, Wendy Okolo, Jennifer Twyman and Peter Laderach also contributed to this blog. Editing by Vivian Atakos, Communication Specialist, CCAFS East Africa

12

Women and environment: Understanding market-based conservation schemes from a gendered perspective

New study reveals widespread gender exclusion in payment for ecosystem (PES) services as a climate change adaptation option.

By Dorine Odongo

Men and women are increasingly recognized as resource managers in crop and livestock-based systems, especially within the context of climate change.

A number of approaches have been adopted towards conservation of natural resources with a view of ensuring environmental sustainability especially in areas where crop and livestock agriculture is the main source of livelihood. These approaches include payments for ecosystem services (PES) – a market-based conservation approach with an incentive for farmers.

Altering natural resource management practices affects how men and women carry out their agricultural activities and influences the welfare outcomes they get. However, despite the recognition of gendered differences in resource access and use, gender inclusion in conservation research and implementation remains limited.

A new study by scientists from the University of Hohenheim and the International Livestock Research Institute (ILRI) explored the extent to which three market-based conservation schemes in Kenya integrate gender in design and implementation. The study, which was supported partly by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), was premised on the hypothesis that for a balanced outcome of its objectives and household welfare, a careful consideration of the intra-household implications of market-based conservation schemes is important.

Need for broader interventions

The study revealed that despite gender differentiated costs and benefits incurred by community members dependent on crop and livestock agriculture around conservation areas, there is widespread gender exclusion in the schemes.

Further, the results found that while cash transfers provide a steady income during periods of climate variability, gender inequality limits women's adoption of PES as a climate change adaptation option.

Unequal land tenure and perception biases were major challenges facing women's direct access to PES benefits which were often accrued and controlled by male household heads.

These findings suggest that market-based mechanisms alone cannot address the gender imbalances characteristic of conservation contexts. However, coupled with side objectives, achieving social outcomes is possible. Thus, the study

Men and women are increasingly recognised as resource managers in crop and livestock-based systems, especially within the context of climate change.

recommends a broader conceptualization of property rights beyond that of ownership to incorporate use rights and labor costs often incurred differently, but considerably by men and women.

Read our special blog series on Closing the gender gap: http://bit.ly/1b3Wnm6

Dorine Odongo is Communications and Knowledge Management Specialist for the Livestock Sytems and Environment Programme - ILRI

13

How climate-smart farming in Kenya influences better policy-making

Climate-smart farmers Ruth and Peter Nguli show East African policy-makers why they should support climate-smart agriculture.

By Cecilia Schubert, Philip Kimeli and Vivian Atakos

For a number of years Peter Nguli and his wife Ruth from Makueni Kenya produced and sold their sun-kissed mangoes at the local market. They were searching for ways to turn it into a more profitable business, but didn't know how to boost this golden yield.

After receiving a series of fruit management trainings including pruning and fertilizer application, as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) climate-smart village activities, annual revenues finally jumped from 220 USD to up to 660 USD. Thrilled with the improved fruit production and quality, the couple is now able to invest in more income-generating farm activities and most importantly pay for their children's school fees.

The right fruit-tree management training from CCAFS and partners helped boost climate-smart farmer Peter Nguli's mango production and income.

The pair has been part of the climate-smart village project for two years now. Together with scientists and extension officers from partners International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the Kenya Agriculture and Livestock Research Organisation (KALRO) and Ministry of Agriculture, Livestock and Fisheries (MALF), they are trialling a selection of climate-smart farm practices and hybrid, drought-resistant seeds to see which techniques work best in this dry region, and which ones are not a suitable match.

Their farm is a fully-fledged learning site, which farmers can visit and see with their own eyes climate-smart farming in practice.

"Our participating farmers choose themselves which farm practices and hybrid seeds they want to work with through seed selection activities," says Justus Ngesu, agricultural extension officer from the Ministry of Agriculture, Livestock and Fisheries working closely with the project. "We buy and disseminate the selected seeds and provide the agriculture trainings that go with them. Our aim is to, though better seed varieties and improved farm management increase farmers' yields per hectare."

Farmers are changing with the climate

Climate-smart farm practices have the ability to support smallholders adapt to, and mitigate, climate change while improving yields and income. In an increasingly dry and heating climate, change is much needed. Both Peter and Ruth can feel a difference in both weather and climate compared to the 1980's, which is why they are eager to try new farm practices:

"Before I used to grow a lot of vegetables and rain-fed maize, but I can't do that anymore. Now, there's little rainfall and the water tables are going low. The temperatures are also changing; it now gets very, very hot," says Peter.

To manage a hotter and drier climate, Peter and Ruth have turned to soil conservation. They use manure and inorganic fertilizers and improved rain-water harvesting techniques to ensure the soil is kept moist and fertile.

"The rain-water harvesting techniques have helped the most", says Peter. "Especially capturing the water run-off from the road, through ditches leading straight to my fruit trees, has really helped with the mango production."

"Water is the main issue in this part of the country. It is very dry and when the rains do come, it is erratic and doesn't penetrate the hardpan soil; almost 70 percent of the rainfall is lost here due to run-off," says Philip Kimeli, a researcher with the CCAFS East Africa program who has been working closely with the participating farmers.

"With the right farm management this can be changed however," he continues. "We encourage everyone to start with water conservation. This includes harvesting the road water run-off, preparing zai pits and micro-irrigation, or constructing terraces to increase water retention and reduce soil erosion. Without water, it will be very hard to implement any climate-smart practice."

With the support from the water saving practices, Peter has tested and documented a myriad of different hybrid, drought-resistant sorghum, millet, bean and pigeon peas varieties through participatory seed selection activities.

Through the various tests, Peter has found that Seredo, a white fast-maturing sorghum variety with a sweet taste, grows really well on his farm and is appreciated by the family. At the same time, sorghum can be challenging to sell on the market, as it has very little local demand, but it does help keep hunger away from the household, Peter explains.

Policy-makers learn from farmers

It is not only Peter and Ruth and their neighbouring farmers who are learning what works under a changing and more extreme climate.

The generated knowledge combined with farmer feedback is used to inform policy-making and institutional change for climate-resilient food systems in East Africa. This is done through various channels, one being engagement in regional networks, for example the Climate and Agriculture Network for Africa (CANA). CANA is a web-based platform seeking to link policy-makers with scientists to address climate change and food security issues. The platform showcases the most recent climate-smart agriculture research while creating opportunities to merge lessons on the ground with regional policy-making.

Policy-makers are also interested to see the climate-smart village activities with their own eyes. Climate-smart farmers in Nyando Western Kenya have on a number of occasions shared their experiences and lessons learned from working with climate-smart farm techniques to various ministries, and delegates from national departments. Most recently a delegation from the Ethiopian Government, keen to explore which climate-smart practices could be replicated, and scaled-up in their own country, visited the activities. Later this year a delegation from the Rwandan Ministry will be visiting the Makueni village-activities.

Climate-smart knowledge goes global

Ruth and Peter's experiences, and the experiences from many other climate-smart farmers, will be further presented and discussed at the Global Science Conference on Climate Smart Agriculture held in Montpellier, France, which kicks-off today!

The ambition is to get the scientific community on climate-smart agriculture up to speed with the most recent advancements while outlining recommendations for policy-makers. Here, sharing smallholders' own experiences will be critical to establish a sustainable global research agenda for climate-smart agriculture.

Learn more on Kenya's climate-smart farms through a lens: http://bit.ly/1NWPDsm

Story by Cecilia Schubert, Communication Officer for CCAFS Flagship on "Policies and Institutions for Climate-Resilient Food Systems", and the CCAFS East Africa team, Vivian Atakos, Communication Officer and Philip Kimeli, Researcher.

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Climate-smart women farmers breaking gender barriers in Kenya

Climate-smart farmers Josephine Mutua and Queen Teva in Eastern Kenya are taking the lead on their farms and in the community, breaking gender barriers and changing perceptions of women.

By Cecilia Schubert and Vivian Atakos

"Before I didn't say anything, during meetings," says farmer Josephine Mutua, a soft-spoken but assured woman from Eastern Kenya. "Now that I have knowledge about different agricultural techniques I have the confidence to speak up and share the information in church or when I have visitors," she explains

Josephine credits this change to her role in managing a climate-smart learning site as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) climate-smart village activities in Makueni, Kenya. Together with her neighbour Queen Teva, the duo is taking the lead to show how women can make their farms climate-smart. As they gain new skills and knowledge, there is no limit to what they can achieve.

Queen Teva and Josephine Mutua have been actively participating in the village activities for the last two years. With support from local partners they lead two learning sites trialling a number of climate-smart techniques and drought-resistant seeds to learn what works best for their area, and which practices are not a suitable match. Getting it right is important; as climate-smart farm practices have the ability to support smallholders adapt to, and mitigate, climate change while improving yields and income.

Both women agree that getting involved in the climate-smart village activities has impacted their lives, both in terms of increased yields, but also in how they are viewed by their fellow community members and friends:

"I feel like the community members respect me more, as I now train others, I am involved in community meetings and talk to visitors who want to see my plot," says Josephine. "I feel proud as I am able to teach others about agriculture technologies"

On the food production side, Queen explains; "I used to get 2 bags of Sorghum but now I get 4-5 bags from the same acre from planting drought-resistant seeds."

"I feel a sense of relief, as I now know a number of agriculture techniques that I can use on my farm. I know my family will be food secure and I don't have to worry like before," she continues.

Women less aware

The ladies were chosen to champion these practices because of their keen interest to keep farming in an increasingly warm and dry climate. Their husbands, who normally work outside the household, support their wives in leading the way on the farm and in the community and are happy with the changes they've seen.

However in most households they would typically be the ones taking the lead on climate-smart farming as recent research shows that women in Africa are less likely than men to be aware of the practices. This is because channels of disseminating agricultural information do not favor women.

Getting the information out to women farmers and socially marginalized groups is therefore key, as the same research shows that women who know about the practices are just as likely as men - if not more - to adopt them. Josephine and Queen's achievements exemplify these findings.

"We identify and work directly with women within the climate-smart villages activities, building their capacity to implement farm techniques that are suitable to them and their needs," says Mary Nyasimi, a gender expert working with the CCAFS East Africa program. "Getting women onboard is really key to ensure the project gains momentum among the community members as they are usually the ones managing the farm when the men work outside the home."

Queen Teva to the left and Josephine Mutua, the two climate-smart farming champions.

The farm practices that Josephine and Queen are implementing are tailored to the region's dry and infertile land. Both are working with partners International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the Kenya Agriculture and Livestock Research Organisation (KALRO) and Ministry of Agriculture, Livestock and Fisheries (MALF), on soil conservation practices, hybrid legume- and cereal intercropping and non-organic fertilizer application to preserve soil moisture and boost yields.

They have also built soil terraces, retention ditches and established micro-irrigation systems throughout their plots, all crucial water and soil conservation techniques to achieve climate-smart outcomes on their farms. In addition, the women offer peer-support to nearby farmers who have committed to evaluate at least one hybrid seed variety.

Members getting organised

CCAFS works with the Kenyan Ministry of Agriculture, Livestock and Fisheries (MALF) which provides agriculture extension services and trainings while supporting mobilization of community groups. This has kick-started a flurry of income-generating activities in the area.

Many of the newly mobilized community-groups are now involved in informal and essential financial savings activities including table-banking, lending and borrowing money with small interest, and merry-go-round saving schemes, where members award individuals with a small pot of money on a rotating basis.

The ambition is to connect the groups with official micro-finance institutes, to help them further scale-up their activities such as poultry and livestock businesses. With 70 percent of the groups made up of women, including Josephine and Queen, there is great potential that the women in the area will be the ones responsible for boosting the households' incomes.

Breaking through gender barriers

Josephine and Queen's work is just one remarkable tale of women around the world breaking through agricultural gender barriers. These barriers mean women receive less agriculture information than men, are less flexible to travel due to household chores and caring for family, and have access to fewer resources to invest in their farm plot. These women are taking the lead to adapt to a changing climate on their farms and in the community. Their efforts are helping to change perceptions and attitudes, which hopefully will create more equal opportunities for men and women farmers in the future.

Read more on climate services: bit.ly/1mR7Iv3
Read more on how can we turn climate information into action? : bit.ly/148E2Az

Story produced by Cecilia Schubert, Communication Officer for CCAFS Flagship on "Policies and Institutions on Climate-Resilient Food Systems", in collaboration with Vivian Atakos, CCAFS East Africa Communication Officer

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Effective climate-smart farming methods for smallholder farmers in Lushoto, Tanzania

A participatory approach to increase climate-smart agriculture uptake is taking place in Lushoto, Tanzania under the Policy Action for Climate Change Adaptation (PACCA) project.

By Naomi De Groot

It is not something that will happen somewhere far away in the future; or that will take place on the other side of the globe. Climate change is directly influencing the rain patterns in Lushoto district, in the West Usambara Mountains of Tanzania. Consequently, farmers living off the fields here are learning to live with these new circumstances. Adapting their ways of sowing, fertilizing and irrigating is the only way these farmers can ensure enough food to feed their children and the rest of the country.

The interdisciplinary project Policy Action for Climate Change Adaptation (PACCA) working together with teams from International Center for Tropical Agriculture (CIAT), the Selian Agricultural Research Institute (SARI) and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) talked to these farmers and their local government in order to map in what ways they are adapting. Taking on a new method of farming is not just about which practices work best. According to the farmers themselves, how well one can adapt to the challenges of climate change is greatly determined by someone's well-being.

Well being relates to the economic, social and environmental status of a farmer in both the present and in the future. In Lushoto, farmers are characterized as worst off, best off and mid-well being families. Best off farmers are described as well educated men and women owning valuable assets; livestock, farms, businesses and houses. Farmers have constant and regular income, they use improved varieties of seeds and are food secure. Worst off farmers do not have many assets; farmers do not own farms or houses and for those who do, houses have thatched roofs and dirt floor. Farmers are food insecure and are usually unemployed or depend on primitive employment. Mid-well being farmers are educated and food secure. They have assets such as houses, usually operate small- scale businesses or are small scale traders and land owners.

Other factors that impact which methods are best used to adapt are the ago-ecological zone in which farmers live, how labor intensive the crops are, know how and availability

Agroecological zones and CSA adoption

For high altitude area, recommended practices include: implementation of cut and carry, optimal use of fertilizer, silvo-pastoral system, crop rotation, water harvesting, minimum tillage and intercropping. For lower altitudes the practices included: early planting, Optimal use of fertilizer, Intercropping, Cut and carry, Terracing, Water harvesting, silvo-pastoral system, Strip cropping, Crop rotation and Composting.

Lushoto, Tanzania has been identified as one of the areas in East Africa, that will suffering from extreme weather conditions due to climate variability. The challenges have also been compounded by poor land management practices.

A workshop was organized to capture experts – agricultural, environmental, climate and gender experts from a range of institutions – opinions on adaptation and locally appropriate Climate – Smart Agriculture (CSA) practices. Similar to the farmers, the experts used agro ecological characteristics as the basis for selecting CSA practices and gave recommendations for the These practices have also been examined by experts; people from agricultural, environmental, climate and gender institutions whom were also interviewed on their opinions and climate smart practices. These experts, who also took into consideration the different agro ecological areas for their recommendations, urge that it is important that these practices are shared and up scaled.

Increasing smallholders awareness of CSA

This knowledge must be shared. A good way of providing smallholder farmers with this valuable information is the use of privately and publicly owned demonstration plots. A tool that has been successful already for education smallholder farmers in Lushoto, according to the experts interviewed during this PACCA research.

Having climate smart agricultural practices incorporated in national policy will also stimulate adaptation by farmers. The experts also called for more research on these practices; costs-benefit analyses should be considered before out-scaling and further implementing these climate smart practices. And that is precisely what the PACCA project will do within the Lushoto site in the next coming months

Learn more about agroforestry: bit.ly/1BHqn0O
Access baseline surveys for the CCAFS Learning sites: bit.ly/1BHqx8s

Naomi De Groot is a communications officer for IITA Uganda and a freelance videographer for CSO's at See OurStory.org.

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How community based organizations are promoting climate- smart crops and practices in drylands

Smart farm innovations and financial services are now accessible to smallholders in Eastern Kenya. Farmers in the area regularly meet through community based organizations to share crucial information and knowledge.

By John Recha, Solomon Kilungu and Philip Kimeli

Kikumini village and Wote Agricultural Training Centre in Wote, eastern Kenya attracted over 450 farmers who came together to learn about climate-smart agriculture technologies and practices. This was during an annual farmer learning event held in January 2015. The event was convened by local community based organizations in partnership with the Makueni County Department of Agriculture, Livestock and Food Security, Kenya Agricultural and Livestock Research Organization (KALRO), and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

Wote is one of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) climate-smart villages in East Africa. The area is representative of typical dryland areas in the region. The soils pose challenges to agricultural productivity due to severe erosion, low fertility, low water holding capacity and high soil crusting and compaction. Long-term annual rainfall records show that amounts are low, at 500 mm. Climate change has added more challenges to the local community, by subjecting them to rainfall variability, and emerging pests and diseases.

Hunger months experienced per family

A survey by CCAFS in the year 2012 revealed that only 2% of the households in Wote are 'food secure' all year long. Only 1% had enough food for their families for at least 10 months of the year, and 97% of the households struggled to get enough food to feed their family for more than 2 months out of a year. Generally, most farmers grow maize, cowpeas and pigeon peas as the staple food; with a low yield of the maize crop of less than 0.4 tons per hectare per year, achieved by 53% of the farming households.

To tackle these problems, people organized themselves into13 self-help groups, from 452 households, that created two large umbrella community based organizations (CBOs). Consequently, the CBOs began working with KALRO, ICRISAT, and county government extension agents to test promising sorghum legume intercrops.

"Under the new CBO arrangement, the farmers can be taught and provided with technical expertise on both improved agronomic and better water management practices. Once they embraced that, land and water use efficiency will increase and translate into more yield per hectare" Rachael Kisilu Crop Scientist, KALRO

During the farmer field day farmers were also educated on feed management and effective conservation methods.

With a combined CBO innovation fund of USD 21,000, the CBOs are already linked to local micro-finance institutions for credit facilities. Through these services, one CBO has purchased a 0.5 hectare piece of land for intensive horticulture. The same CBO intends to work with the Food and Agriculture Organization (FAO) project to promote conservation agriculture. By linking with the private sector and other development organizations over 1,000 households will be mobilized this year to take part in promotion of resilient dryland crops of sorghum, pigeon peas, and green grams, linking them with markets.

Farmer learning events for transfer of knowledge

One of the strategies used by the CBOs to exchange knowledge in the local communities is convening farmer learning events to showcase the technologies. Apart from the resilient crop varieties, improved agronomic and postharvest practices are displayed and used to teach to local community. The practices include crop rotation, intercropping, optimum spacing, use of terraces, water harvesting, micro-irrigation, improved processing and storage, integrated pest management, and composting.

Champion farmers are used to showcase the various technologies.

> "Josephine Mutua is a farmer who can teach the others about the innovations on her farm. If the other farmers embrace these practices the whole community will thrive under the changing climate" Mary Muteti, the Makueni County Director of Agriculture & Food Security, who was the chief guest

Josephine's farm has a water harvesting pan with a capacity of 50,000 litres. It fills up twice a year in each rainfall season. A shade net covers the top to reduce evaporation and a dam liner at the bottom prevents leakage. This water is pumped manually and brought to specific farm locations for irrigation when the soil is too dry to grow crops.

Read about intercrop innovations may help build resilience in semi-arid areas: http://bit.ly/1NWUdXv

John Recha is a Post Doctoral Fellow - Participatory Action Research, Solomon Kilungu is a Communication Assistant and Philip Kimeli is a Research Assistant. They all work for CCAFS East Africa. The story was edited by Vivian Atakos - Communication Specialist, CCAFS East Africa.

Out & About

1. Policy makers from the Kenya Ministry of Environment, Water and Natural Resources (MEWNR) at the Mazingira lab in ILRI Campus. 2. Mary Muteti County Director of Agriculture Makueni County, Kenya during a farmer field day in Makueni. 3. Policy makers from Rwanda learning about ongoing work in Nyando.

In our diary

April
24-30
2015

CBA9: 9th conference on community-based adaptation to climate change
Venue: Nairobi, Kenya

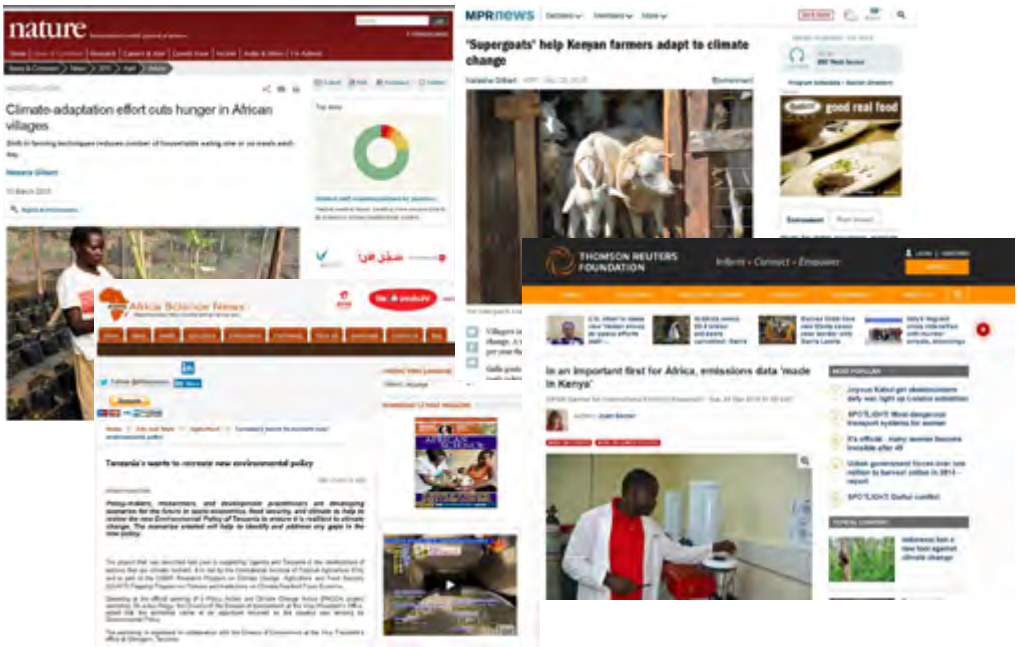
May
7
2015

Independent Science Panel (ISP) and Program Management Committee (PMC) Field Visit to Nyando
Venue: Kisumu, Kenya

June
1-11
2015

Bonn Climate Change Conference (SBSTA)
Venue: Bonn, Germany

CCAFS EA in the media



Climate-adaptation effort cuts hunger in African villages (nature) http://bit.ly/1BBtnwp
Tanzania's wants to recreate new environmental policy (Africa Science News) http://bit.ly/1IQJIRX
'Supergoats' help Kenyan farmers adapt to climate change (MPR News) http://bit.ly/1OltONS
In an important first for Africa, emissions data 'made in Kenya' (Thomas Reuters Foundation) http://tmsnrt.rs/1IQKkqE

Further Reading

CCAFS Latest Publications

Working Paper: Agricultural Adaptation and Institutional Responses to Climate Change Vulnerability in Ethiopia: bit.ly/1JbjqXp

Working Paper: Integrating Indigenous Knowledge with Scientific Seasonal Forecasts for Climate Risk Management in Lushoto District in Tanzania: bit.ly/1Hfm4fR

The Role of Policy in Facilitating Adoption of Climate-Smart Agriculture in Uganda: http://bit.ly/1bo0XMX

Climate-smart villages and the hope of food secure households: http://bit.ly/1HcHD2a

Working Paper: Evidence of Impact: Climate-Smart Agriculture in Africa: bit.ly/1DrZUGL

Evidence of impact: Climate-smart agriculture in Africa: bit.ly/1FybpOO

Resources and Tools

CCAFS website and blog updated daily with news on policy and practice, research, events and downloadable publications from the CGIAR and partners.

Website: bit.ly/1gX2uKi Blog: bit.ly/Blogs_EastAfrica

Adaptation and Mitigation Knowledge Network (AMKN) is a map-based platform for sharing data and knowledge on agricultural adaptation and mitigation. bit.ly/AMKN_Maps

AgTrials Large public repository of agricultural trial data sets, with different crops, technologies and climates. bit.ly/AgTrials

Food Security CASE maps Map-based projections of crop area and yields, average calorie availability, and international trade flows across the world. bit.ly/Casemaps

MarkSim II Generator of future location-specific rainfall series, based on a choice of General Circulation Models. bit.ly/MarkSimGCM

GCM data portal Set of downscaled climate data sets. bit.ly/Climate_Data

Dataverse Public portal for full CCAFS data sets such as the baseline surveys from CCAFS East Africa sites that include information on farmers' current adaptive practices. bit.ly/Baseline-Surveys

Big Facts website Get all the links on climate change, agriculture and food security. bit.ly/1gYWjWt

Atlas of CCAFS sites Browse colourful maps of CCAFS research sites in three regions: East Africa, West Africa and South Asia. bit.ly/1iSfwHd

Core Sites in the CCAFS regions This portfolio includes brief descriptions of CCAFS core sites in East Africa, West Africa and South Asia, including coordinates of the sampling frames of the baseline surveys. bit.ly/1dKwrfG

Adaptation and Mitigation Knowledge Network is a map-based platform for sharing dataand knowledge on agricultural adaptation and mitigation. bit.ly/1kiEnng

Climate Analogues This is a tool that uses spatial and temporal variability in climate projections to identify and map sites with statistically similar climates across space and time. bit.ly/1pzmVhl

Climate and Agriculture Network for Africa: This is a web-based platform seeks to link scientists with policy makers to address climate change, agriculture and food security issues in Africa. bit.ly/1BHmhG0

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